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February 27, 2004

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CERTIFIED COPY OF PRIORITY DOCUMENT

APPLICATION NUMBER: *60/436,546*
FILING DATE: *December 24, 2002*
RELATED PCT APPLICATION NUMBER: *PCT/US03/39995*

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

T. Lawrence

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PRIORITY DOCUMENT
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12-27-02 604 546 . 122402 PROV

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PTO/SB/16 (8-00)
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Michael	Bonner	12427 31 Mile Road Romeo, MI 48095

☐ *Additional inventors are being named on the____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

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☒ Firm *or* Individual Name	Dinnin & Dunn, P.C.				
Address	2701 Cambridge Court				
Address	Suite 500				
City	Auburn	State	MI	ZIP	48326
Country	US	Telephone	248-364-2100	Fax	248-364-2200

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages*	8	☐ CD(s), Number	
☐ Drawing(s) *Number of Sheets*	2	☐ Other (specify)	
☐ Application Data Sheet. See 37 CFR 1.76			

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☒ Applicant claims small entity status. See 37 CFR 1.27.
☒ A check or money order is enclosed to cover the filing fees
☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number 04-1131
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): $80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
☒ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: ______

Respectfully submitted,

SIGNATURE Robert A. Dunn

Date 12/23/02

TYPED or PRINTED NAME Robert A. Dunn

REGISTRATION NO. *(if appropriate)* 30,556

Docket Number: 1634-00002

TELEPHONE 248 364 2100

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

P19SMALL/REV05

jc951 U.S. PTO
12/24/02

604 546 . 122402

PTO/SB/17 (11-01)
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FEE TRANSMITTAL for FY 2002

Patent fees are subject to annual revision.

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	$80.00

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Michael Bonner
Examiner Name	
Group Art Unit	
Attorney Docket No.	1634-00002

METHOD OF PAYMENT *(check all that apply)*

☒ Check ☐ Credit card ☐ Money ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number	04-1131
Deposit Account Name	Dinnin & Dunn, P.C.

The Commissioner is authorized to: *(check all that apply)*

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	80.00
				SUBTOTAL (1)	$80.00

2. EXTRA CLAIM FEES FOR UTILITY AND

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =	0	X		=	0.00
Independent Claims		- 3** =	0	X		=	0.00
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) $0.00

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FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non - English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR § 1.17(q)	
126	180	126	180	Submission of Information Disclosure Statement	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	740	246	370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1.129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) ______________________

*Reduced by Basic Filing Fee Paid SUBTOTAL (3)

SUBMITTED BY				Complete *(if applicable)*	
Name (Print/Type)	Robert A. Dunn	*Registration No. (Attorney/Agent)*	30,556	*Telephone*	248 364 2100
Signature	Robert A. Dunn			*Date*	12/23/02

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CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): Michael Bonner			Docket No. 1634-00002
Serial No.	Filing Date	Examiner	Group Art Unit
Invention: PROFILE TRACED INSULATED COVER ASSEMBLY			

I hereby certify that this Fee Transmittal// Prov App for Patent Cover Sheet // Prov Application // Drawings
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is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Commissioner of Patents and Trademarks, Washington, D.C. 20231-0001 on December 23, 2002
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P06B/REV02

"PROFILE TRACED INSULATED COVER ASSEMBLY"

TECHNICAL FIELD

The present invention relates generally to heat exchanger systems for pipes, and more particularly to such a system utilizing a readily installed flexible cover assembly having a plurality of thermally conductive fluid transfer profiles maintained in thermal contact with the pipe.

BACKGROUND OF THE INVENTION

There are a wide variety of applications where heated or cooled fluid is delivered over a length of conduit. Typical industrial applications include fluid coatings or adhesives that are applied at specific assembly or processing stations in a plant. The fluid may thus be stored in an area remote from the one or more dispensing stations. However, it is often advantageous to control the temperature of the fluid, whether to lower the viscosity to facilitate fluid transfer or to maintain a desired temperature at the point of application as a matter of application process efficiency. It is generally preferred to perform the bulk temperature control at the point of introducing the fluid into the system, particularly where there are multiple application points. During delivery of the fluid to the application station, a change in fluid temperature will result if the ambient temperature varies from the initial control temperature. The temperature gradient increases as the difference between the ambient temperature and control temperature increases and as the length of the conduit increases.

In many of these fluid delivery systems, it has become desirable to reduce temperature variation along the conduit or even to adjust the temperature along the conduit. United States Patent No. 5,363,907 to Dunning et al. shows an example of such systems.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide an efficient, safe means for adjusting or maintaining the temperature of material in a fluid conduit.

It is a further object of the present invention to provide an easily installed and efficiently operated heat exchanger for insulating and regulating the temperature of material in a fluid conduit that positions a plurality of thermally conductive fluid transfer profiles in thermal contact therewith.

SUMMARY OF THE INVENTION

In accordance with the foregoing and other objects, the present invention comprises a flexible cover that can be fastened about a fluid conduit, the flexible cover including a plurality of thermally conductive fluid transfer profiles positioned therein, each of the profiles having a longitudinal surface contoured to substantially mate with a longitudinal surface of the fluid conduit, wherein fastening of the cover engages the fluid transfer profiles in intimate contact with the fluid conduit.

The present invention allows installation of a heat exchanger to an existing system, representing a substantial improvement over many earlier methods requiring cutting, welding, or similar processes to install a coaxial heat exchanging system. Unless installed at the time of system construction, prior methods required separating the pipe to be heated, draining and purging the pipe, then sliding a larger section of pipe over the subject pipe. The exterior pipe could be used to circulate fluid past the interior pipe in a coaxial relationship. Once this is done, however, both the exterior pipe and the internal, subject pipe must be welded or otherwise sealed, a time-intensive, potentially dangerous and costly prospect. The multiple sealing points further present an added risk of leaks (in either the heated system or the exterior heating pipe) that can foul or damage the system and require downtime for maintenance. Because water is typically used as the heating fluid, corrosion tends to cause leaks whereby material can pass into the water stream or water can pass into the material in the inner pipe, having dire consequences. For example, in systems where hot urethane material is transferred through a pipe, the accidental introduction of even a small quantity of water can cause solidification of the material within the entire system, ruining much of the equipment. Furthermore, many such systems utilize flammable, caustic or otherwise dangerous materials in their operation, often creating significant disposal and safety issues. Moreover, the systems must often be cleaned with toxic or flammable materials to prepare the system for

reintroduction of fluid material. In light of the above concerns, the present invention provides substantial savings in material costs and labor. Obviating the need to drain and cut into an existing system also provides a significant improvement in safety..

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of an unfastened cover assembly according to a preferred embodiment of the present invention;

Figure 2 is a close-up perspective view of a cover assembly fastened about a pipe according to a preferred embodiment of the present invention;

Figure 2a is an end view of a cover assembly similar to Figure 2;

Figure 3 is an end view of a cover assembly according to a preferred embodiment of the present invention;

Figure 4 is a close-up perspective view of a cover assembly fastened about a pipe according to a preferred embodiment of the present invention;

Figure 5 is an end view of a cover assembly having barbed fittings, in accordance with a preferred embodiment of the present invention;

Figure 6 is a perspective view of positioning profiles having right-angle fittings, in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention comprises a cover assembly that serves as an insulator and heat exchanger with a conventional fluid transfer conduit such as a pipe. The cover assembly can be quickly and easily wrapped about a pipe and connected to a supply of heated or chilled fluid to regulate the temperature of the subject pipe and its contents. Referring to Figure 1, there is shown an exemplary cover assembly 10 that includes a flexible cover 11, within which a plurality of thermally conductive fluid transfer profiles 12 are positioned. When unwrapped, as shown in Figure 1, cover assembly 10 is preferably substantially rectangular, and can be joined when wrapped along longitudinal edges 15 and 17. In a preferred embodiment, flexible cover 11 is wrapped around a pipe 20, bringing fluid transfer profiles 12 into intimate contact with the pipe. The phrase "intimate contact" should be understood to encompass both direct physical contact and

indirect thermal contact via an intermediate thermally conductive material, as described herein. A heated (or chilled) thermal transfer fluid may then be passed through the profiles 12, absorbing or delivering thermal energy to the pipe and the material contained therein. In addition, the air temperature in the space created by the wrapped cover assembly is affected by the temperature of the fluid in profiles 12. Contact between this heated or chilled air and the surface of the pipe further enhances the insulating and/or adjusting effect of cover assembly 10. Where greater or lesser temperature adjustment of the subject pipe is desired, the temperature and/or flow rate of fluid in profiles 12 can be adjusted. Further, flow of the thermal transfer fluid may be restricted to fewer than all the profiles 12. It should be appreciated that although the present invention is contemplated for use primarily as a means for heating pipes containing incompressible fluids, it is equally applicable where it is desirable to chill a pipe and its contents, or where the pipe transfers compressible fluids. Thus, as recited herein, references to "heating" the subject pipe should not be construed to limit the scope of the present invention. The cover assembly described herein will find similar utility in raising, lowering or maintaining the temperatures of a pipe and its contents.

Cover 11 is preferably formed from a flexible fabric that can be wrapped around the pipe that is to be heated. Although fabrics are preferred for most applications, for instance woven polyesters or other common polymers, where the temperatures encountered are relatively great, highly heat-resistance polymers or other suitable, non-polymeric materials may be used. Because cover 11 is preferably formed from multiple layers of material, various insulating layers may be incorporated therein, both to enhance the heat-resistance of the cover material itself and to improve the temperature control capabilities of the cover assembly, as described herein. In one preferred embodiment, one or more layers of flexible insulation material, for instance fiberglass, is/are affixed between two layers of durable polymeric fabric. The layers can be glued, riveted, ultrasonically or thermally welded, or attached by any other known means. In a preferred embodiment, the layers are sewn together. Various combinations of insulating, protective or decorative materials may be used.

Cover assembly 10 is primarily contemplated for use in established systems that require, for example, supplementary heating, however, cover assembly 10 might also be

incorporated as part of an original system design. An attachment means comprising a releasable engagement of a longitudinal strip having a plurality of hooks 19 with a longitudinal strip having a plurality of loops 21, as known by the tradename Velcro®, may be used to secure cover 11 about the subject pipe. Other embodiments are contemplated, however, in which a zipper, buttons, clasps, tape or some other attachment means is utilized without departing from the scope of the present invention. Because it is desirable to effectively thermally isolate the environment within the wrapped cover from ambient, attachment means are preferred which substantially block air exchange along the attached longitudinal edges of the cover 19 and 21. The dimensions of cover 11 are variable, and will be greater or lesser depending on the length and diameter of the pipe whose temperature is to be adjusted.

Cover assembly 10 preferably includes a plurality of retaining straps 14 sewn to the inside of cover 11. Straps 14 are preferably formed from a strip of material sewn at multiple locations across cover 11 to create a plurality of loops receiving profiles 12. Other attachment means are contemplated, such as welds or glue, as well as the use of individual straps. In addition, embodiments are contemplated wherein cover 11 is provided with sleeves sewn to, or integral with, the layered cover. Profiles 12 are preferably inserted into straps 14, which assist in positioning profiles 12 when cover assembly 10 is engaged with a pipe. Two sets of straps are preferably provided, and are positioned at opposite ends of cover 11 such that a strap is engaged with each profile at opposite ends. The straps may be formed from any suitable material, and may be formed from a thermally conducting material if desired. It should be appreciated, however, that straps 14 are preferably fabricated such that they create a minimal gap between profile 12 and the subject pipe.

Various alternative embodiments are contemplated wherein a cord or strap, for example, a zip-tie, is fed through cover 11 or around its exterior, and secured to assist in holding cover assembly 10 snugly against the pipe. In some circumstances, such a design assists in positioning and maintaining profiles 12 in thermal association with the pipe. One example of such an embodiment (not shown) includes a plurality of conventional, commercially available plastic zip-ties wherein the zip-ties are passed through channels in cover 11 that are oriented substantially perpendicular to the orientation of profiles 12.

Thus, once cover assembly 10 is engaged about the pipe, the zip-ties can be engaged and tightened, constricting cover 11 about the pipe, and assisting in positioning profiles 12 in intimate contact with the pipe. Similar designs (also not shown) use straps that can be sewn, for instance, to the interior of cover 11, or passed through channels therein. The respective ends of the straps are preferably fitted with mating buckles that can be engaged, and the straps tightened about cover assembly 10.

While a preferred embodiment of the present invention has been described in which a flexible, fabric cover is utilized, it should be appreciated that alternative embodiments are contemplated. For example, a relatively rigid, multi-piece hinged cover might be substituted so long as the profiles can be brought into intimate contact with the pipe when the cover is engaged therewith.

In a preferred embodiment, the profiles are positioned substantially radially symmetrically about the pipe. Referring now in addition to Figures 2 and 2a, there are shown side and end views, respectively, of cover assembly 10, similar to Figure 1. Figures 2 and 2a illustrate the preferred positioning of profiles 12 about a pipe 20. As also shown in Figures 2 and 2a, profiles 12 preferably include internally threaded fittings 18 at their ends for in-line connection with a fluid circulation/distribution system. In addition, profiles 12 are preferably bent radially outwardly relative to a longitudinal axis of the pipe proximate the points at which profiles 12 are connected to the rest of the system, i.e. at the fittings. The outward bend of profiles 12 facilitates attachment with supply/drain lines, hoses, etc. Referring to Figure 4, there is shown an embodiment incorporating a "barbed" fitting 118 for engagement with a resilient mate, for instance, a flexible hose. Figure 6 illustrates yet another alternative, in which a right-angle fitting 218 is utilized. By utilizing profiles according to the Figure 6 embodiment, cover assembly 10 can be more easily utilized in environments where space is at a premium, for example, and it is advantageous to attach cover assembly 10 to perpendicular fluid supply/drain lines.

Profiles 12 are preferably elongate hollow members suitable for circulating a heat conducting fluid. It is contemplated that a wide variety of fluids might be utilized as the heat conductor in the present invention. Propylene glycol or similar materials, various mineral and organic oils, water and other fluids, both compressible and incompressible,

might be used, depending on the heat transfer needs of the system, materials, and operating temperatures. Referring to the drawing Figures generally, profiles 12 may be fabricated from any suitable, thermally conductive material. Preferred metals include both ferrous and non-ferrous metals, although relatively soft metals such as copper or aluminum are particularly preferred. Softer metals tend to be easier to form to the desired shape, and often have a relatively greater thermal conductivity than harder metals. In addition to metals, embodiments are contemplated wherein thermally conductive plastics are used.

Profiles 12 may be formed by any known, suitable method. For example, the profiles may be extruded, stamped, roll-formed, molded, cast, milled or manufactured by some other process. Profiles 12 are preferably formed such that they have a surface substantially mating with the subject pipe, typically substantially arcuate. Figure 3 illustrates an exemplary assembly wherein profiles 12 have a substantially arcuate inner surface 13 that conforms with the pipe 20. The mating relationship between the profiles 12 and pipe 20 optimizes the area of mutual contact, and thus optimizes the capacity to conduct heat therebetween. It is preferred that a heat-conducting gap filler (not shown) is placed between profiles 12 and pipe 20 to enhance the thermal conductivity between the two. There are many such materials known in the art, and various greases, pastes, creams, and gels are readily commercially available. Further still, there are numerous dry, thermally conductive foams and tapes known in the art that may be applied, for example with a thermally conductive adhesive.

The cross sectional geometry of profiles 12 may be tailored for particular applications. For instance, profiles 12 might be fashioned to have a relatively greater area of surface contact with a pipe than the examples in the drawing Figures, and a correspondingly flatter cross section. Similarly, larger or smaller profiles can be used to increase or decrease the fluid flow capacity, or the effective area of surface contact with the pipe, depending on system requirements. The wall thickness of the profile along its side of contact with the pipe can also be adjusted to provide varying degrees of thermal conductivity. Where it is desirable to heat a curved pipe, cover assembly 10 may be fashioned with bendable profiles 12 that can be bent in conformity with the pipe. In general, embodiments utilizing fewer profiles are preferred in order to minimize the

number of fluid connections in the system, however, fluid flow rates tend to decrease with increasingly flattened profiles, and wider profiles tend to be more challenging to manufacture. The embodiment pictured in Figure 3 utilizes four profiles 12, with an exemplary 1" pipe 20. The Figure 5 embodiment, on the other hand, utilizes six profiles 12, with an exemplary 2" pipe 20. The disclosed embodiments should not be considered limiting, and any number or conformation of profiles might be used without departing from the scope of the present invention.

A typical installation process utilizing a cover assembly according to the present invention begins by selecting an appropriately sized and designed cover assembly. Cover assemblies according to the present invention may be any length or size, or have essentially any number of fluid transfer profiles, limited only by the length and diameter of the pipe to be fitted, and the thermal exchange requirements of the system. Once the desired cover assembly is selected, the pipe surface is prepared. This may include cleaning or otherwise treating the pipe surface to ensure the most effective transfer of thermal energy. Before applying the cover assembly, a thermal transfer material such as thermal transfer grease is preferably applied longitudinally along the arcuate surfaces of the profiles. The pipe itself might alternatively be coated with the thermal transfer material. The cover is then wrapped circumferentially around the pipe and secured, preferably bringing the profiles into secure contact with the pipe, with the layer of thermal grease positioned between the pipe and profiles. Once secured, the profiles can be connected to the thermal fluid circulation system in any known fashion.

The present description is for illustrative purposes only, and should not be construed to limit the breadth of the present invention in any way. Thus, those skilled in the art will appreciate that various modifications might be made to the presently disclosed embodiments without departing from the intended spirit and scope of the invention.

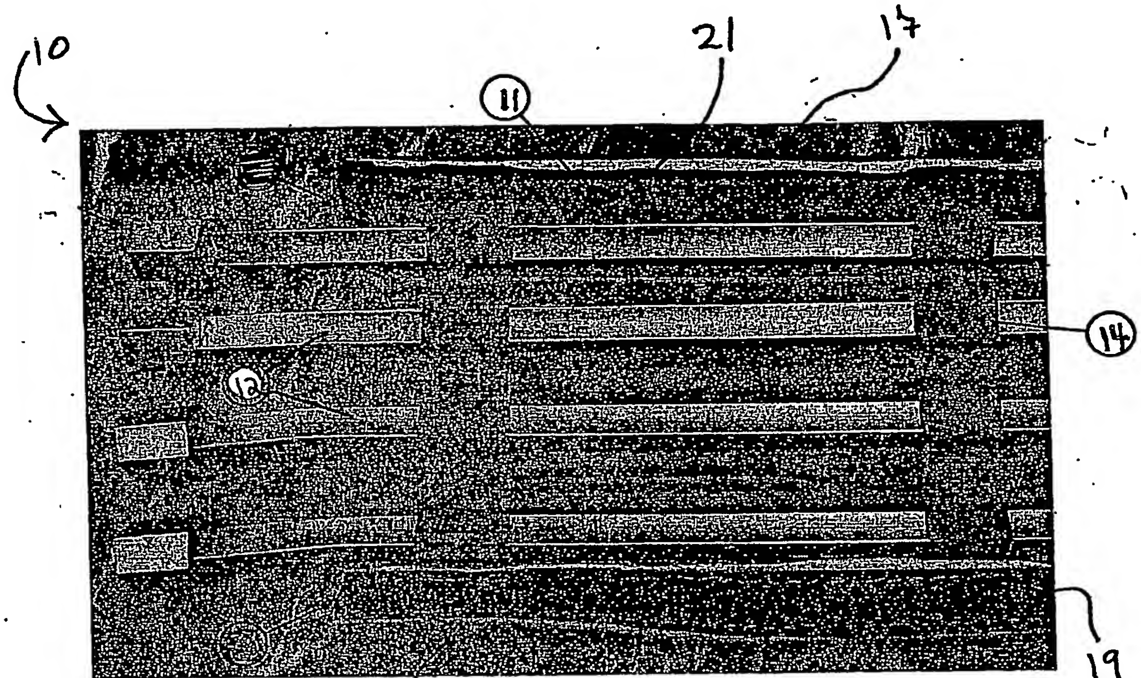

Figure 1

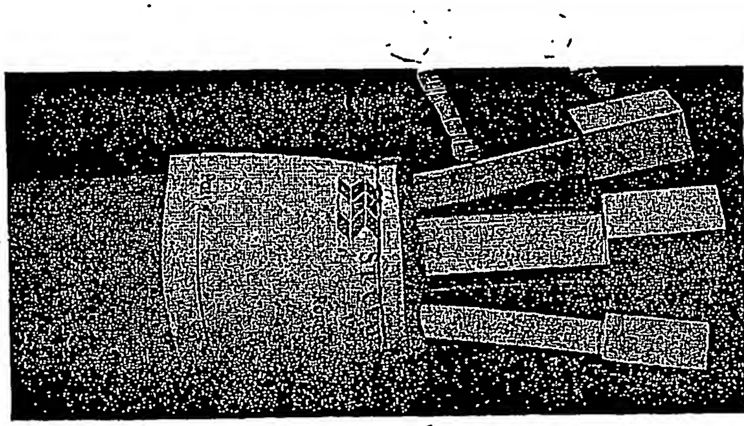

Figure 2 10

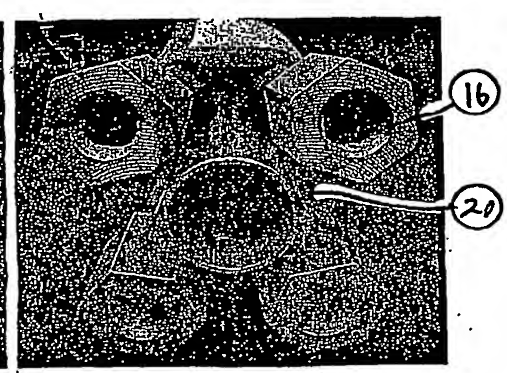

Figure 2a 10

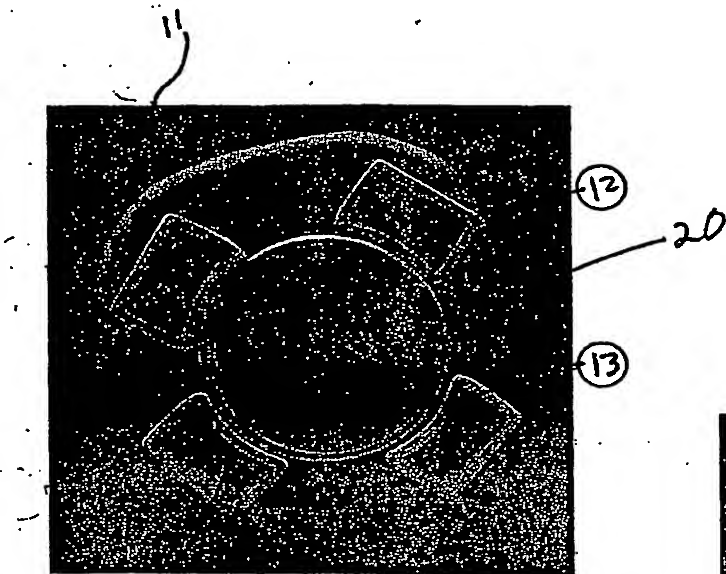

Figure 3

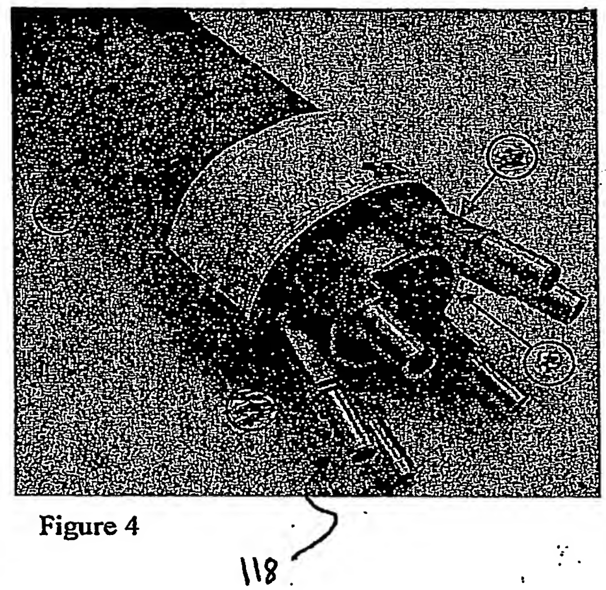

Figure 4

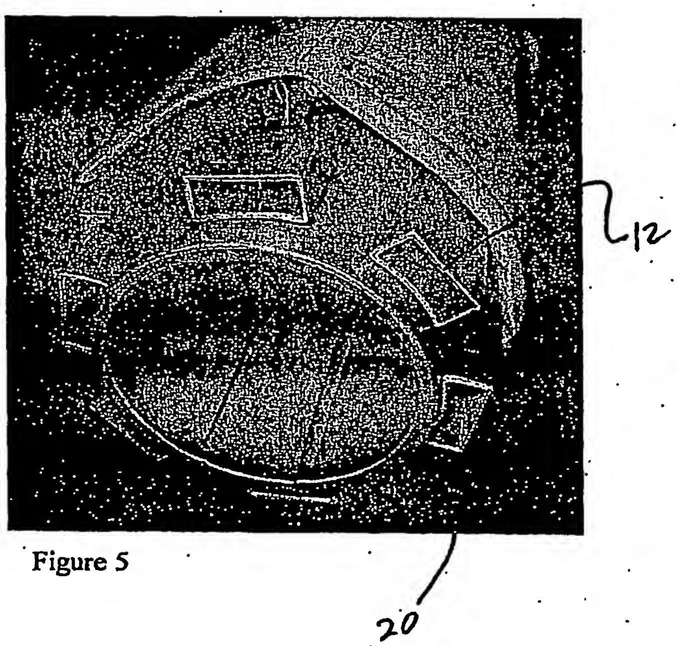

Figure 5

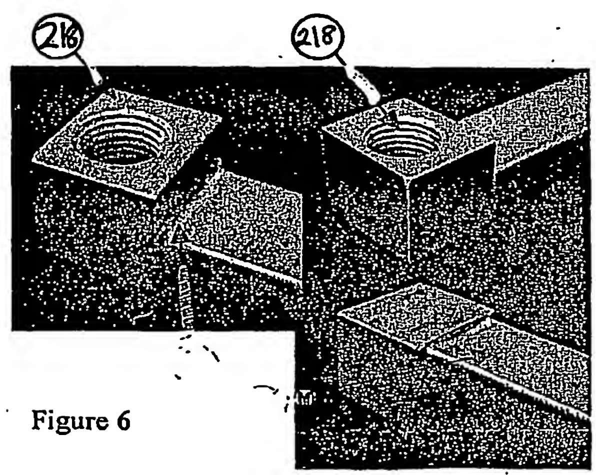

Figure 6